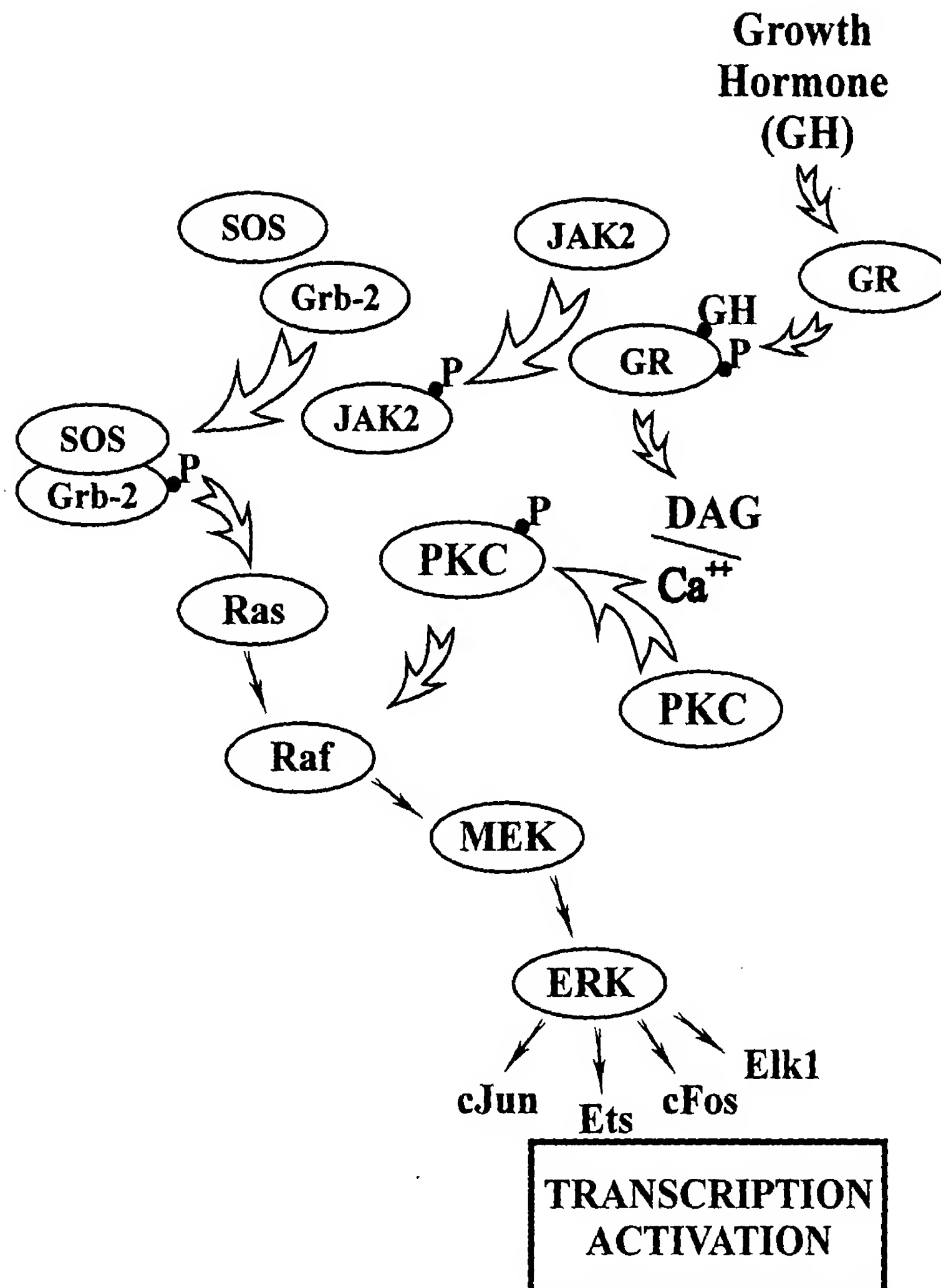
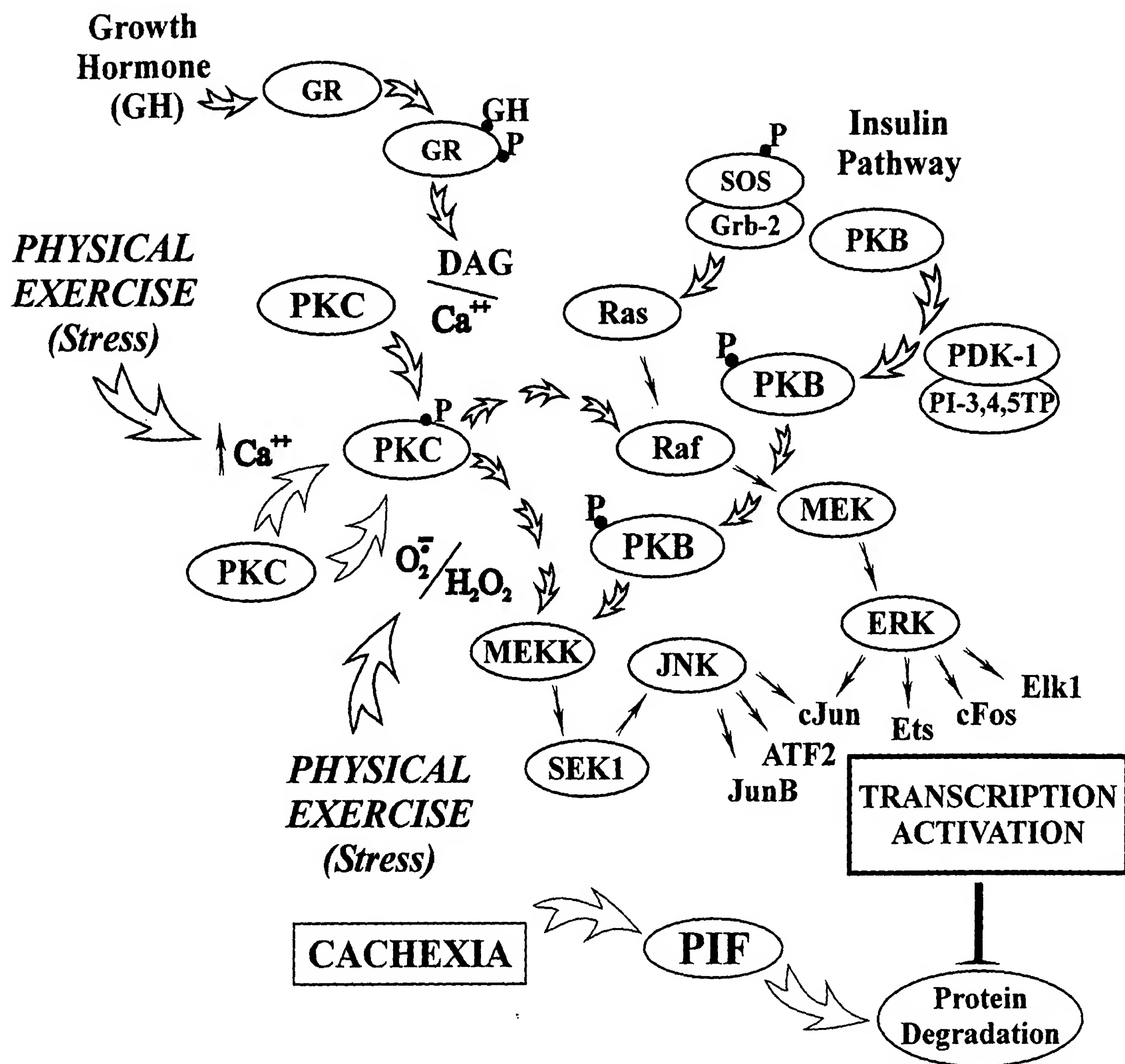


**Figure 2. Insulin-mediated activation of the MAPK pathway of transcription activation.** Both the activated IRS-1,2 (through activated JAK2) and the PDK-1:3,4,5TP complexes can activate the SOSGrb-2 complex which in turn activates ras of the MAPK pathway, resulting in enhanced protein synthesis.

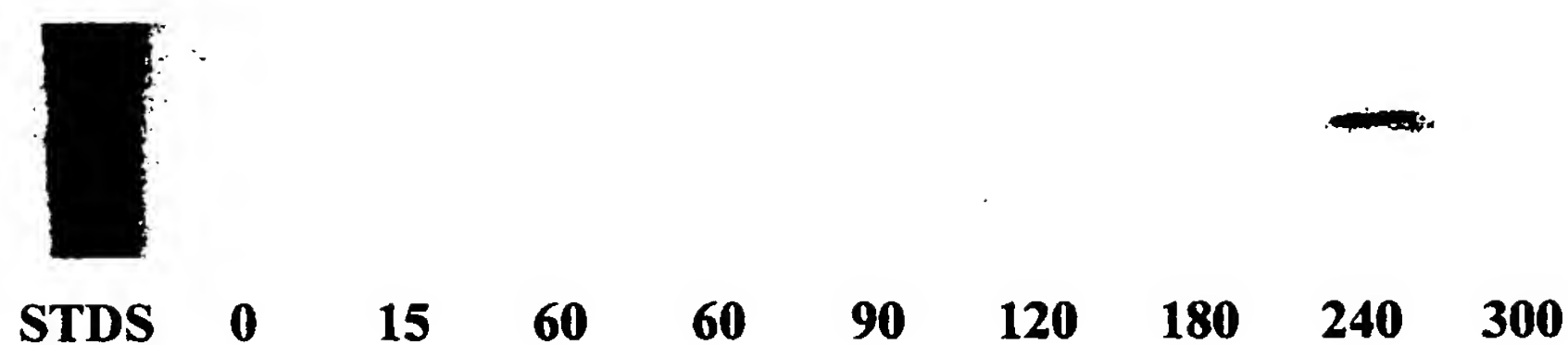


**Figure 3. Growth-hormone (GH)–mediated activation of the MAPK pathway of transcription activation.** The activated growth hormone receptor (GR) activates JAK2 which mediates the activation of ras via the SOSGrb-2 complex. Activated GR also stimulates the release of Ca<sup>++</sup> into the cytosol (via DAG) which activates PKC. PKC in turn activates raf of the MAPK pathway; activation of both ras and raf results in enhanced protein synthesis.



**Figure 4. Interactive effects of physical exercise, insulin, and growth hormone on activation of the SAPK and MAPK pathways of transcription activation.**

PKC is activated by physical exercise through enhanced  $\text{Ca}^{++}$  and ROS as well as by growth hormone through DAG/ $\text{Ca}^{++}$ . PKC in turn activates the SAPK and MAPK pathways by activating MEKK and raf, respectively. By enhancing insulin sensitivity and activating SAPK and MAPK independently if insulin and growth hormone, physical exercise should greatly enhance rates of protein synthesis beyond that expected by insulin or growth hormone alone; resulting in an attenuation of prevention of cachexia-associated muscle wasting and fatigue.



**Figure 5. The effect of acute running exercise on Jun content of lung nuclei from rats.** Rats were exercised for 60 minutes and 3 rats killed at each time period of 0, 15, 30, 60, 90, 120, 180, 240, and 300 minutes from the start of the exercise. Lung nuclei were probed for jun using anti-cJun/AP-1 antibody in a western blot procedure. The blot was digitized, converted to grayscale, and the 35-45 kDa region of the blot which included the immunoreactive protein was then printed using an HP Photosmart 1215 printer at highest resolution.